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United States Department of Agriculture,

BUREAU OF PLANT INDUSTRY,

SEED DISTRIBUTION,

WASHINGTON, D. C.

DISTRIBUTION OF COTTON SEED IN 1911.

The present will be the ninth distribution of cotton seed carried on by this office in cooperation with the cotton-breeding investigators of the Bureau of Plant Industry.

During the past eight years forty-four varieties of cotton have been distributed. These have all been bred by the experts of the Bureau of Plant Industry or selected by them because of special local value.

From the reports so far received it is evident that as a rule the seed sent out by the Department of Agriculture has proved better than that commonly obtainable. This year's distribution adds two varieties to those previously sent out.

An introductory statement on "The Improvement of the Cotton Crop by Selection" has been prepared by Mr. O. F. Cook, who now has charge of the cotton-breeding work of this bureau, to explain how the seed may be utilized to the best advantage by the farmer.

LEON M. ESTABROOK,
Assistant in Charge.

Approved:

G. H. POWELL,
Acting Chief of Bureau.

WASHINGTON, D. C., December 14, 1910.

DISTRIBUTION OF COTTON SEED IN 1911.

THE IMPROVEMENT OF THE COTTON CROP BY SELECTION.

How can the farmer make the best use of a small stock of seed of a superior selected variety? By understanding and applying the methods by which select seed is produced, so as to keep the selected variety from deterioration. The usual way of treating a small quantity of select seed is not at all calculated to enable the farmer to learn the true value of a new variety or to preserve the purity of an improved stock.

TESTING NOT TO BE COMBINED WITH SELECTION.

A mistake made frequently by farmers, and sometimes by professional breeders, is to attempt to combine testing with breeding. The new variety of cotton is planted by the side of the local variety or a mixed stock, in order to test its behavior, and seed is saved from the same planting to increase the stock of the new variety. This plan is open to the serious danger that the seed of the new variety when gathered in the fall will not be pure, but will be contaminated by crossing with the local variety, so that its special value will be lost. The amount of crossing differs with the locality and the season, depending on the abundance of bees or other insects that carry the pollen from one flower to another, but there is usually too much crossing to make it safe to rely on the purity of any stock of seed that has been grown close to another variety of cotton.

ISOLATION OF SEED PLATS.

A farmer who wishes to make a really adequate test of the value of a new variety should plant the seed in a separate plat, removed as far as possible from other fields of cotton. Such an isolated planting does not provide, of course, for a close comparison with the local variety, but this can be made in the following year to much better advantage. With the larger stock of seed then available a field planting can be made, as well as test plantings. In the third year there will be enough seed to stock even a large farm with the new variety, if it shows itself superior. Though the quantity of seed

distributed to the individual farmer is small, careful planting will make it serve for an acre or two. One correspondent got a stand of between three and four acres by hand planting and raised two bales of cotton the first season.

Most farmers are probably unwilling to give the proper care to a new variety until they have made a preliminary test and convinced themselves that it is really superior. But those who use this seed for testing purposes and plant it in the same field with another variety or a mixed stock of cotton are advised not to save seed in the fall with any idea that they are keeping a pure stock of the new variety in this way. If the farmer is convinced that the new variety is superior he should get a fresh stock of the seed and plant it in a separate breeding plat, as far as possible from any other field of cotton.

It is not proposed, for the future, to limit the distribution of seed of superior varieties of cotton to a single season, as the custom has been in the past. A second distribution of a desirable variety seems likely to be of quite as much use as the first in helping to bring an improved type of cotton into general cultivation. To increase the number of varieties in a community is not desirable. On the contrary, there would be a distinct advantage if the whole community would grow one variety, if the best variety could be determined. The danger of mixture of varieties by crossing and the mixture of seed at the gin would both be reduced, and the uniformity of the product would enable the community to secure a higher price for its cotton.

WHY SELECTION MUST BE CONTINUED.

Unless selection is continued the value of a variety is sure to decline. A well-bred variety is superior to ordinary unselected cotton not only in having better plants but in having the plants more nearly alike. Whether selection has any power to make better plants is a question, but there can be no doubt of the power of selection to keep the plants alike. Even in the best and most carefully selected stocks inferior plants will appear, and if these are allowed to multiply and cross with the others the stock is sure to deteriorate. The pollen from the flowers of inferior plants is carried about by bees and other insects and the seeds developed from such pollen transmit the characters of the inferior parent. Even if they do not come into expression in the first generation they are likely to reappear in the second generation.

To grow cotton from unselected seed involves the same kind of losses as in an orchard planted with unselected seedling apple trees. Less cotton is produced and the quality is also inferior. The higher the quality of the cotton the more stringent is the requirement of a uniform staple. Unless the fibers have the same length and strength they can not be spun into fine threads or woven into strong fabrics.

PRESERVATION OF VARIETIES BY SELECTION.

The method of selection to be followed in preserving a variety from deterioration is entirely different from that employed in the development of new varieties. The breeder of new varieties seeks for exceptional individuals, and prefers those that are unlike any variety previously known. If the selection is being carried on to preserve a variety, the object is not to secure seed from the peculiar plants, but to reject all that deviate from the characters of the variety. The first qualification for such selection is a familiarity with the habits of growth and other characters of the variety, to enable the farmer or breeder to confine his selection to the plants that adhere to the "form" or "type" of the variety, and to reject all that vary from the type. Most of the latter would prove to be very inferior, and at the same time would increase the diversity of the variety and hasten its degeneration.

IMPROVED METHODS OF FIELD SELECTION.

No matter how good a new variety may be or how carefully it may have been bred and selected, inferior plants are likely to appear, especially when it is grown under new and unaccustomed conditions. A special effort is being made to limit the distribution to seed from uniform fields of cotton, but selection is necessary to keep any variety from deterioration, and it is useless to wait until the deterioration becomes serious before beginning the selection. If proper attention be paid to the roguing out of inferior plants in the first season there may be much less variation in the second, the variety becoming better adjusted to the new conditions.

As uniformity is one of the first essentials of value in a variety, the behavior of a new variety in this respect is one of the first things to be noted. Do not wait till the crop matures, but watch the plants in the early part of the season. Even before the time of flowering, it is possible to distinguish "freak" plants by differences in their habits of growth or the characters of their stems and leaves. Whenever such variations can be detected, they should be pulled out at once in order to prevent the crossing of the good plants with inferior pollen. After the bolls begin to reach mature size it is well to go through the plat again and pull out all plants that show by the small size or other peculiarities of the bolls that there has been a variation from the standards of the variety. These preliminary selections greatly simplify the final selection in the fall, when attention can be limited to the yield and to the characters of the lint and seeds.¹

¹ Methods of selection are treated in greater detail in Circular No. 66 of the Bureau of Plant Industry, U. S. Department of Agriculture, entitled "Cotton Selection on the Farm," which can be obtained upon application to the Secretary of Agriculture. See also Bulletin No. 159 of the Bureau of Plant Industry, U. S. Department of Agriculture, entitled "Local Adjustment of Cotton Varieties."

USE OF PROGENY ROWS IN SELECTION.

Selection can be made still more efficient by the use of progeny rows. The seed of select individual plants is picked separately into paper bags and planted in the next season in adjacent rows, in order to test the behavior of the progenies of the different individuals. An inferior progeny can be rejected as a whole and selection limited to the best rows. It often happens that a very good plant produces a comparatively inferior progeny, which would not be excluded from the stock unless the progeny-row test were made.

Nevertheless, the use of progeny rows is no substitute for skill and care in making the selection, for if the selected plants are not all of the true type of the variety, admixture by cross-pollination will occur in the progeny rows the same as in a mixed planting. Protection against the danger of crossing between different progenies can be secured by holding over a part of the seed of the select individuals used to plant the progeny rows. The remainder of the seed that produced the best progeny row can be planted in an isolated breeding plat in the year following the progeny test. In this way a special strain is developed from a single superior plant.

METHODS OF TESTING COTTON VARIETIES.

The best way to test the behavior of two varieties of cotton is to plant them in alternate rows so that they can be compared carefully during the growing season, and the yield of each row weighed separately at the end of the season. Of course it is often possible to judge that one variety is superior to another without weighing, but if the results are nearly equal, weighing is necessary. Even experienced cotton men are likely to make errors in guessing at the yields of different rows of the field. A variety that "scatters" its lint may appear to be yielding much more than a stormproof variety with dense, compact lint that can be shown to be much more productive by comparison of actual weights of seed cotton and percentages of lint.¹

ADMIXTURE OF SEED IN GINS.

One of the most serious difficulties in maintaining the uniformity of a superior variety of cotton is the mixture of seed in gins. A few farmers have their own gins or small hand gins for their seed cotton, and in some localities ginning establishments are beginning to provide small gins that are kept clean for ginning seed cotton. Some farmers

¹ See Circular No. 11 of the Bureau of Plant Industry, entitled "Danger in Judging Cotton Varieties by Lint Percentages," which may be had free of cost upon application to the Secretary of Agriculture.

take care to avoid the mixture of seed by holding their seed cotton until the end of the season, when the time can be taken to clean out the gin. It is also possible to plant progeny rows or seed plats with unginned seed by wetting the lint before planting.

O. F. COOK,
Bionomist in Charge.

LONE STAR, A NEW VARIETY.

(Distribution arranged by Mr. D. A. Saunders.)

The Lone Star variety has been developed from a single superior plant found in a field of Jackson cotton in the Colorado River bottom near Smithville, Tex., in August, 1905. The seed had been purchased from a local cotton planter who had obtained a carload of seed from the originator, Mr. J. M. Jackson, Preston Bend, Tex., three years previously. The field was very variable as to size of boll, quality of lint, etc., allowing an unusual opportunity for selection.

In 1908 plats of this selection large enough to give a fair test of yield and lint qualities under field conditions were planted at Waco, Denison, and Cuero, Tex. The yield, percentage, and quality of lint were better than in any other variety with which it was compared. In 1909 the variety was named Lone Star. Three bales were raised near Waco which were said by expert cotton buyers to be the three best bales raised in the county that season.

Following is a short technical description of this variety:

Plant of medium height, with one to four limbs and many long fruiting branches; main stem very short jointed and less hairy than the majority of big-bolled varieties; the limbs ascending, generally producing fruiting branches at their base; fruiting branches numerous, horizontal or ascending, long, medium short jointed; leaves medium to large, very dark green; petioles very long, somewhat drooping or recurved; bolls very large, round or broadly ovate, an inch and a half to an inch and three-fourths in diameter, an inch and three-fourths to 2 inches in length, with very short, blunt points, 35 to 45 to the pound; involucral bracts very large, closely appressed, coarse veined, deeply cut into long teeth, the longest teeth often meeting over the end of fully developed green bolls; pedicels of medium length, an inch and a half in length below to three-fourths of an inch at the top of the main stem and the extreme ends of the primary and fruiting branches; the burr thick and heavy with very blunt points; lint an inch to an inch and an eighth in length, very strong, and of uniform length of fiber, 38 to 40 per cent.

In this variety the limbs begin to develop fruiting branches 4 to 7 inches from their base instead of near their extremity. This should be of advantage under weevil conditions, as in years of heavy infestation the bulk of the crop must be obtained from the lower third of the plant. In selection, considerable stress has been laid upon the

short-jointed character of the main stem as essential in developing an early fruiting tendency.

The seed for this distribution was grown in the vicinity of Waco, Tex., by Messrs. John Gorham, Will Gorham, D. M. Crenshaw, James Sligh, and W. T. Ford, and by Warren Blakley, of Eddy, and S. E. Johnson, of Hubbard City, in the season of 1910.

HARTSVILLE.

(Distribution arranged by Mr. F. L. Lewton.)

During the summer of 1902, 20 selections of Jones improved cotton were made by Mr. D. N. Shoemaker, of the Bureau of Plant Industry, on the farm of Mr. D. R. Coker, at Hartsville, S. C. The selection was continued by him the next year and in 1904 was turned over to Mr. Coker, who has continued to breed this cotton according to the most approved methods.

The plants are of medium height, not of cluster type; the bolls large, roundish oval, averaging about 60 to the pound. The lint measures $1\frac{1}{8}$ to $1\frac{3}{16}$ inches and is very uniform in length and strength, averaging 34 to 35 per cent. Further details regarding the characters of this variety have not yet been worked out, so that no formal description of the variety can be given at this time.

The fields of Hartsville cotton on Mr. Coker's farm where this seed was produced were carefully inspected by the cotton experts of the Bureau of Plant Industry and showed a most remarkable degree of uniformity. This variety is now being largely grown in Darlington County, South Carolina, and when handled with proper care sold at a premium of 2 cents over other Upland cotton in the season of 1910. In order to secure a premium it is necessary to pick the cotton with care, not only to exclude leaves and other "trash," but to avoid immature and weather-stained bolls. If a saw gin is used, the speed should not be more than 300 revolutions per minute, to avoid cutting the fiber. It is also necessary that the cotton be dry before ginning.

COLUMBIA, A LONG-STAPLE UPLAND VARIETY.

(Distribution arranged by Mr. E. B. Boykin.)

In the course of the cotton-breeding experiments which were formerly conducted by Dr. Herbert J. Webber for the Bureau of Plant Industry, special attention was given to producing new and improved long-staple Upland varieties. One strain which has been under very careful selection for seven consecutive generations at Columbia, S. C., has shown very marked improvement and has been named the Columbia.

The following is a short statement of the methods used in producing the variety: In the summer of 1902 a plat of Russell Big-Boll

cotton was grown in connection with Dr. Webber's experiments for the purpose of testing the variety in comparison with other sorts and making selections. Every plant in the plat was carefully examined and the lint combed to determine its length. The length of lint was found to be somewhat variable, in general being from 1 inch to $1\frac{1}{8}$ inches. About half a dozen plants were found with lint nearly $1\frac{1}{4}$ inches long, and one particularly good plant had lint averaging about $1\frac{3}{8}$ inches in length.

Several of the best plants that had long lint were planted in 1903 by the plant-to-row method. An examination of the rows when the plants matured brought out the fact that the one plant selected in 1902 that had lint $1\frac{3}{8}$ inches long had reproduced its characters in a marked degree, while the rows planted from the seed of the other plants were only slightly better than the ordinary Russell cotton. The selections made in 1903 were therefore all taken from the progeny of this one superior plant. About 75 per cent of these plants produced lint $1\frac{1}{4}$ inches in length, and about 12 plants gave lint nearly $1\frac{3}{8}$ inches long. Seed was preserved from the 12 best plants only, and this was planted in an isolated plat in 1904 by the plant-to-row method. In 1904 several of the rows of plants were much below the standard set and only one of the rows was considered superior. All of the selections in this season were made from this superior progeny. In 1905 an isolated patch of about $1\frac{1}{2}$ acres was planted again by the plant-to-row method. In this season the variety had been reduced to practical fixity of type and the breeding patch was exceptionally fine and fairly uniform. In 1905 some individual selections were made, after which a considerable number of good second-select plants were marked and saved for seed to plant a multiplication patch in 1906.

In 1906 a multiplication patch of 14 acres was planted with this second-select seed, and this patch produced 25,500 pounds of seed cotton and 7,359 pounds of lint, or 1,821 pounds of seed cotton and 528 pounds of lint to the acre. The lint sold on the market at Columbia, S. C., early in the season at 13 cents a pound. Had it been sold in a long-staple market later in the season it would have brought a much higher price. The lint from the breeding patch of 1906 sold later in the season for $19\frac{1}{2}$ cents.

Throughout the process of selection the aim has been to select plants having the Russell type of branching and boll, so that the plant of the Columbia is scarcely recognizable as distinct from the Russell variety. The very large boll has also been retained and the variety is in every respect of true Upland type aside from its lint character.

The true Russell variety produces a large seed covered with dark-green fuzz. This character is very undesirable, owing to the dis-

coloration of the lint if ginned while somewhat wet by the pulling off of the green fuzz and also owing to the green color giving undesirable linters. In breeding this variety by selection, therefore, special attention has been given to selecting a white seed. The great majority of the plants of the Columbia variety now produce white seed, but this character has not as yet been entirely fixed.

While the variety is now one of the best long-staple Upland sorts, it requires to be further improved in some characters. As will be seen from an examination of the yields of the 14-acre patch, the lint turn-out was only 29 per cent. In increasing the length of lint there has been a slight loss in the percentage of lint. The Russell variety, however, seldom averages more than from 30 to 31 per cent, owing to its very large seed. Practically speaking, this can not be considered a serious drawback to the variety if the yield of lint to the acre holds up, and it is believed that the yield to the acre will average as high as that of ordinary short-staple sorts grown under the same conditions.

In the selection of the variety up to the present time little attention has been given to increasing the percentage of lint. In the selections made in 1906, however, this feature was made one of the important points. It was found that the different selections varied in percentage of lint from 29 to 34½. All of the selections from one row of plants averaged from 32 to 34 per cent.

The crop of 1907 showed a marked increase in the percentage of lint over that of 1906, and it is certain that the variety is greatly improved in this respect. Great care has been exercised to select seed plants having very strong lint, and as a result the initial strength of the lint in the Columbia variety is much greater than in the Grif-fin, the Sunflower, and the majority of the long-staple Upland varieties.

The tests of the Columbia variety made at various places in 1907 and 1908 show that in some places it is a thoroughly satisfactory cotton, while under other conditions it may prove somewhat disappointing. This is what would naturally be expected. Any long-staple cotton to give thorough success should be planted on fairly good soil, rich in vegetable matter, and must be well manured and well cultivated. Such thorough methods will pay.

Dr. Webber has had considerable experience with the long-staple Upland cottons, having grown and tested practically all of the known varieties, and considering all characters he believes the Columbia to be one of the most promising varieties of this class of cotton. He strongly recommends growers to give this cotton a thorough trial for several years, being careful to select the seed for planting in accordance with the method suggested earlier in this paper.

Following is a short technical description of this variety:

Plant low, compact, of Russell type, having several long branching basal limbs, vigorous, prolific; bolls large to very large, ovate, blunt pointed, opening very wide, mainly 5 locked; seeds large, fuzzy, white or greenish, 8 to 10 per lock; lint very strong, from $1\frac{7}{8}$ to $1\frac{3}{4}$ inches in length, fine, silky, and very uniform in length; seeds moderately well covered, giving from 29 to 33 per cent of lint; season of maturing, medium.

The fields of Columbia cotton from which the seed distributed this season was taken were grown by Messrs. P. B. McLendon and R. J. Chapman, of Lamar, S. C., and by Mr. R. C. Keenan, of Columbia, S. C.

The suggestions for handling long-staple cottons made in connection with the Hartsville variety are equally applicable to Columbia cotton.

DILLON, A WILT-RESISTANT VARIETY.

(Distribution arranged by Mr. William A. Orton.)

Besides the foregoing, a wilt-resistant variety will be distributed this year. This has been bred by Mr. William A. Orton, of the Bureau of Plant Industry. A complete description of the wilt of cotton and efficient remedies for it are contained in Farmers' Bulletin No. 333, which may be had on application to the Secretary of Agriculture, Washington D. C. The following description is extracted from this bulletin:

The first of the wilt-resistant varieties to be sent out has been named Dillon from the fact that the original selections were made in Dillon, S. C., in 1900. From 1902 to 1904 it was grown at Troy, Ala.; in 1905 and 1906, at Notasulga, Ala.; and during 1907, 1908, 1909, and 1910, at Lamar, S. C.

The parent variety was Jackson Limbless, a cotton greatly over-exploited at the time of its introduction and not widely grown at the present time. The first variety test showed the Jackson to be much more resistant than other races of cotton, and this quality has been greatly intensified by subsequent breeding. Preliminary distributions were made in 1905, 1906, and 1907, when small quantities of seed were sent out under the name "Wilt-Resistant Jackson" for experimental trials. It was found that this name led to confusion with the unselected original Jackson and that the new strain differed from the original in being more resistant, productive, and uniform, and to some degree in having bolls less closely clustered and easier to pick, seed of darker color, etc. For these reasons the improved strain sent out in 1908 has been named Dillon. A technical description follows:

Plant tall, erect, wilt resistant, productive, often with one, two, or three large basal branches; fruiting limbs reduced to clusters of bolls close to the main stalk; leaves medium size; bolls of medium size, 80 being required to yield 1 pound of seed cotton;

bolls erect; seed small, average weight of 100 seeds 9 grams, covered with close, brownish-green fuzz; staple medium to short, $\frac{7}{8}$ to 1 inch, white, straight; percentage of lint to seed cotton, 37.

The group of Upland varieties having clustered bolls is not very popular among farmers, some being unduly prejudiced against it. In part, however, this feeling is accounted for by the fact that the cotton is harder to pick than that of big-boll varieties. This difficulty in picking is counterbalanced by the stormproof quality, as Dillon has held all its cotton through storms that have blown to the ground all cotton open on other varieties. Greater objections are raised on this score in sections where big-boll varieties are grown than where the prevailing kinds are of the King or Peterkin groups. Further objection is also made to the cluster varieties because the cotton is more trashy after storms, due to fragments of the involucre adhering to the lint.

Breeders should seek to select easy-picking strains of Dillon. The bolls should also be bred to have separate pedicels, thus opening the clusters. Those who object to its faults should not lose sight of the fact that even on land not infected by wilt the Dillon variety has been proved to rank high in productiveness, and on infected land it will yield many times as much as nonresistant kinds. A field in South Carolina where cotton had previously been a complete failure from wilt, even when highly fertilized and intensively cultivated, yielded $1\frac{1}{2}$ bales per acre of Dillon cotton in 1907.

The Dillon variety appears to succeed best in the northern portion of the cotton belt, including North Carolina, South Carolina, and parts of Georgia.

The seed for this distribution was grown in 1910 by Mr. J. R. Register, of Lamar, S. C., under Mr. Orton's supervision.

REPORT OF RESULTS OF PLANTINGS.

In order to determine the comparative value of the different varieties of cotton in various cotton-growing regions, a report will be requested in the autumn of 1911 covering the following points:

- (1) Character of the soil.
- (2) Character of the season.
- (3) Total yield of seed cotton produced. (Determined by actual weighing.)
- (4) Total yield of lint produced. (Determined by actual weighing.)
- (5) Size of patch grown. (Determined by actual measurement.)
- (6) Yield per acre. (Estimated from the patch grown.)
- (7) Rating of the new variety for your section—whether excellent, good, fair, or poor.
- (8) Name of the variety ordinarily grown by the planter making the test.
- (9) Yield of the ordinary variety this year on the same soil as the variety under consideration.

It is especially requested that growers carefully note the points just enumerated in order that they may secure the necessary data and be ready to supply accurate information when it is called for next autumn. In this way it is hoped to obtain valuable and reliable information regarding the varieties best adapted to various sections of the cotton belt.

Growers receiving this seed who are willing to cooperate with the Department of Agriculture in making the above test are requested to fill in and return the accompanying franked postal card, which requires no postage.

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